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Kent

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[54] **METHOD AND APPARATUS FOR PROPORTIONAL AUTO-SCROLLING**

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[22] Filed: **Dec. 22, 1994**

[51] **Int. Cl.**[6] **G09G 5/34**

[52] **U.S. Cl.** **345/123**; 345/145

[58] **Field of Search** 345/123–125, 345/145; 395/138, 157

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Primary Examiner—Jeffery Brier

Attorney, Agent, or Firm—Merchant, Gould, Smith, Edell, Welter & Schmidt

[57] **ABSTRACT**

A method and apparatus for proportional auto-scrolling through data displayed in a window on a monitor attached to a computer. The speed and direction of the proportional auto-scrolling function is determined by the cursor orientation to the window where the data is displayed.

12 Claims, 5 Drawing Sheets

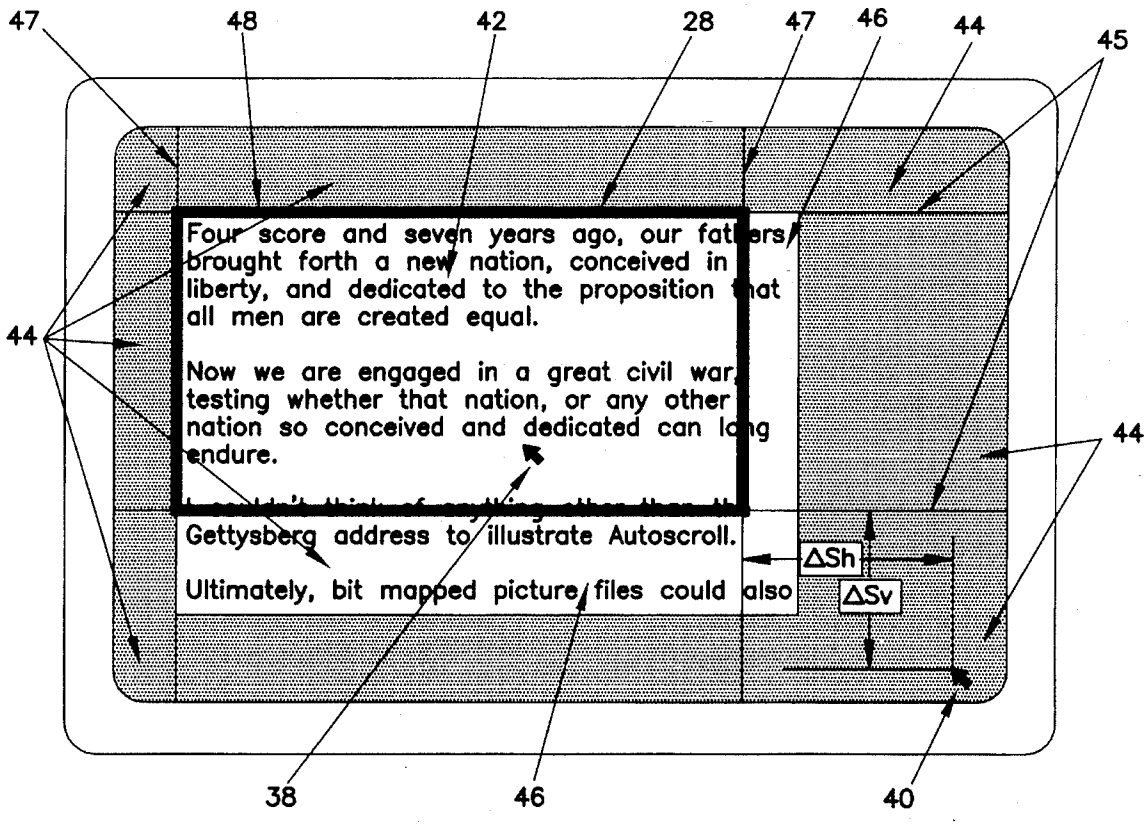


FIG. 1

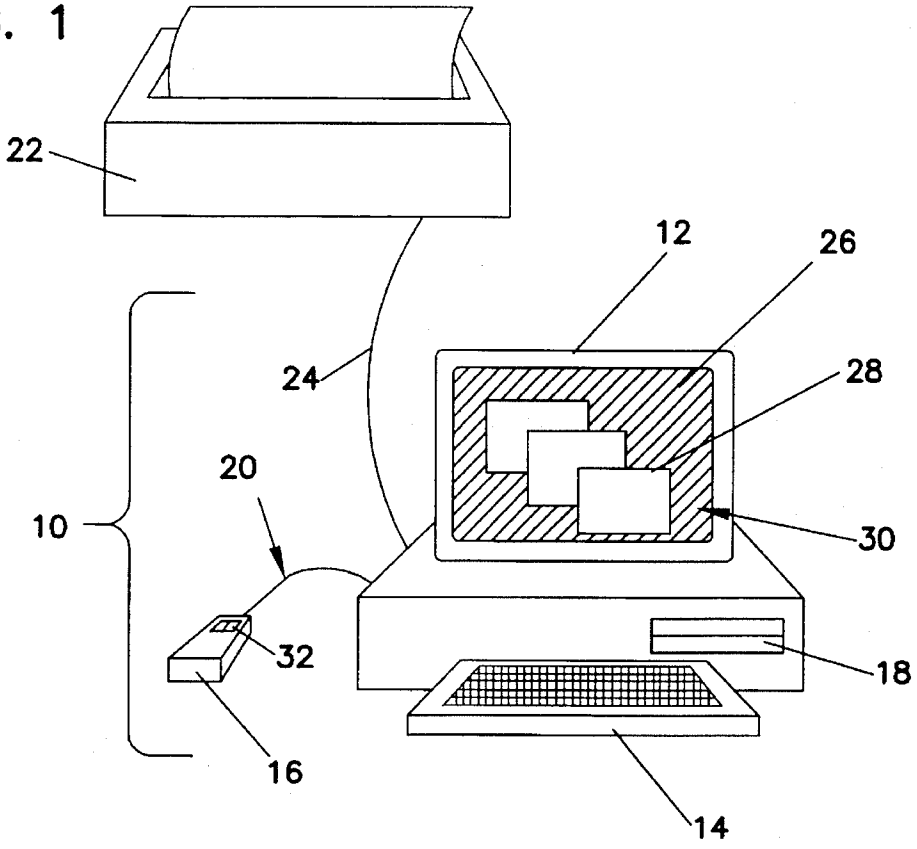
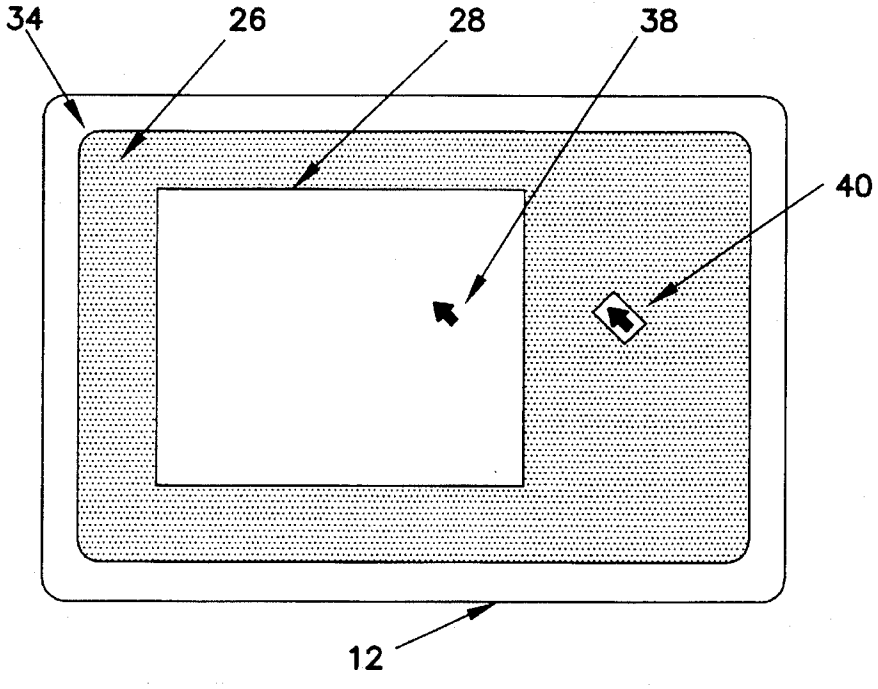


FIG. 2



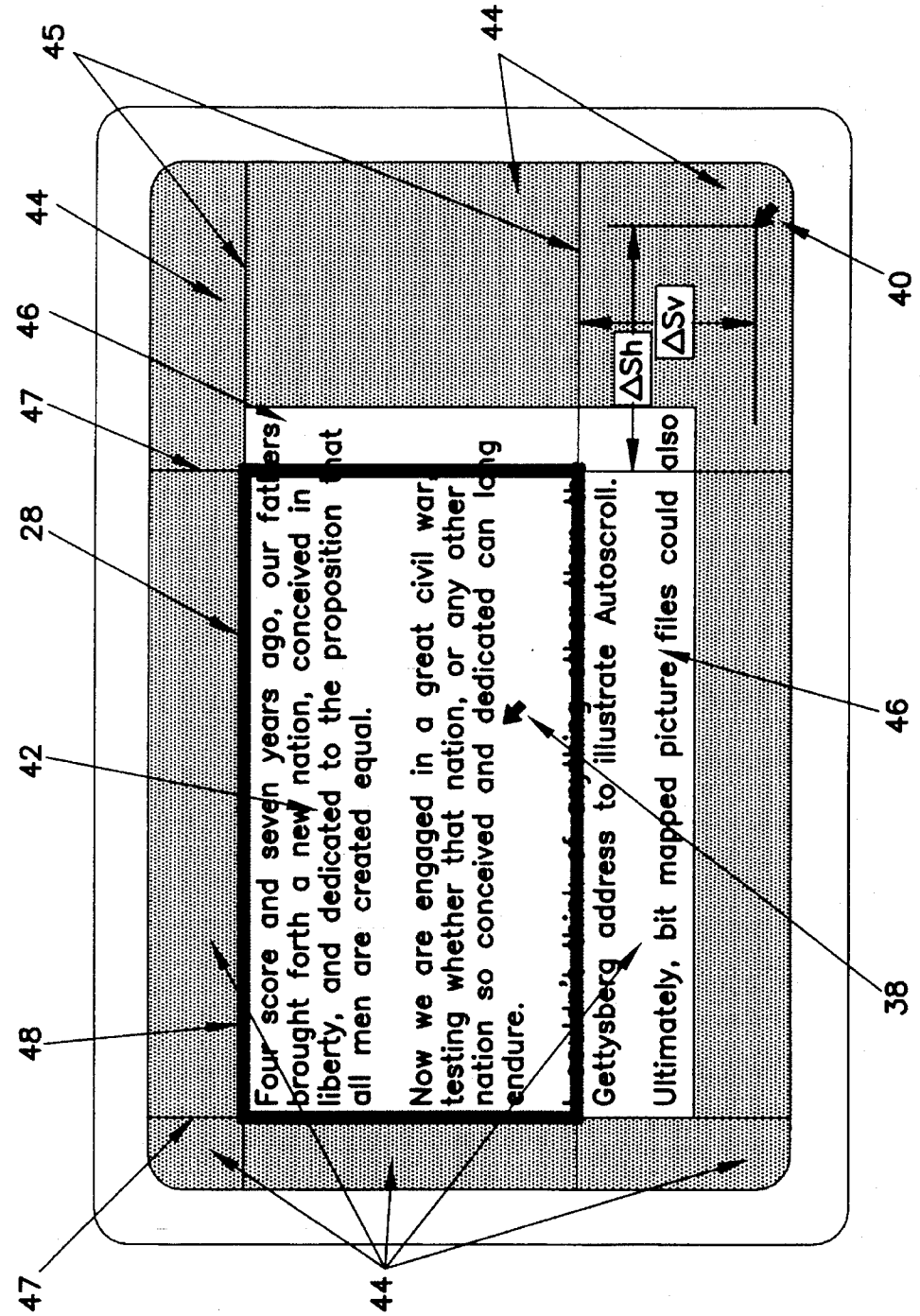

45
44
44
46
47
28
42
48
47
44
40
ΔSh
ΔSv
46
38
Four score and seven years ago, our fat ers
brought forth a new nation, conceived in
liberty, and dedicated to the proposition hat
all men are created equal.
Now we are engaged in a great civil war
testing whether that nation, or any other
nation so conceived and dedicated can lo g
endure.
Gettysberg address to illustrate Autoscroll.
also
Ultimately, bit mapped picture files could

FIG. 3

FIG. 4

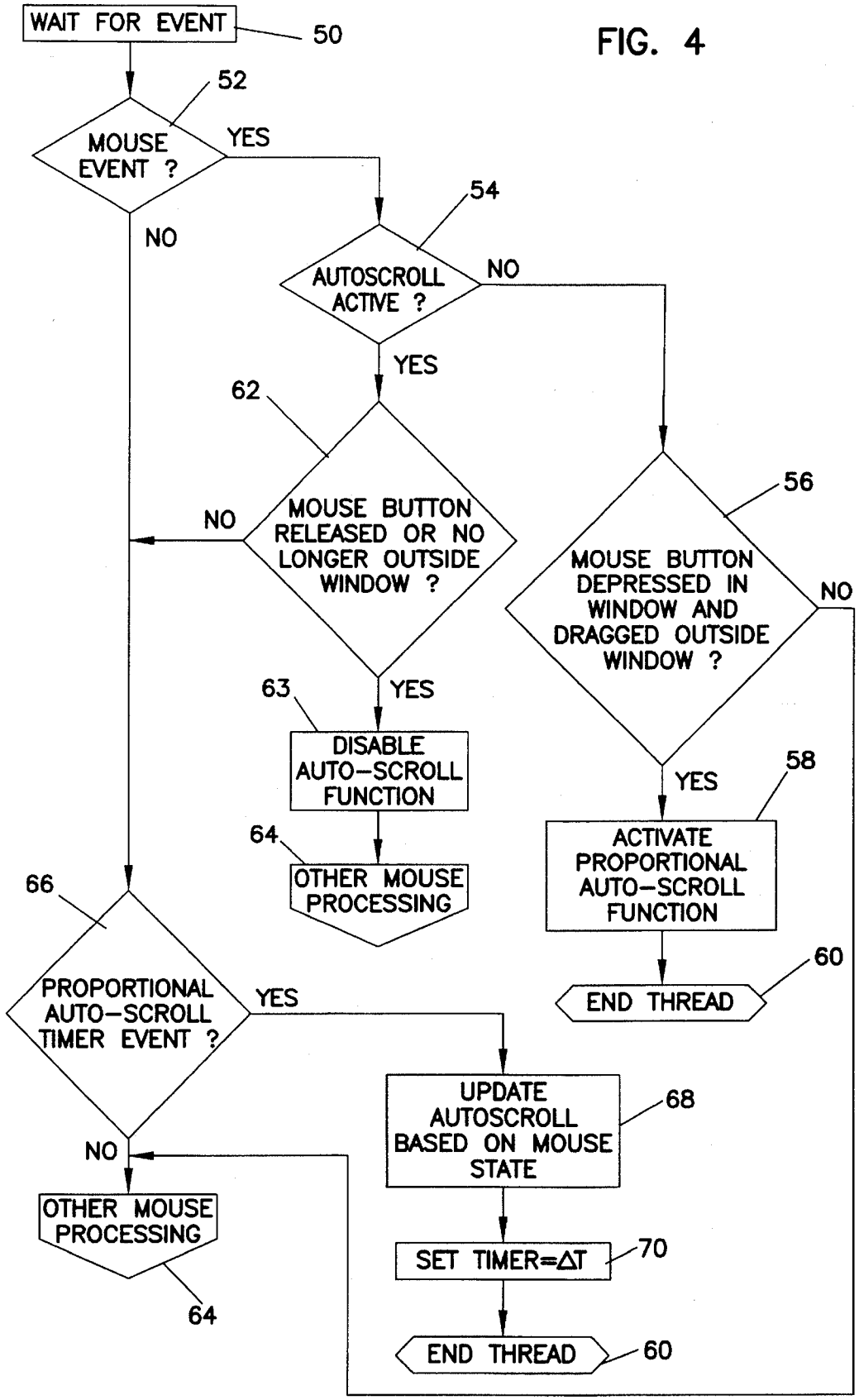

WAIT FOR EVENT
50
52
MOUSE EVENT ?
YES
NO
54
AUTOSCROLL ACTIVE ?
NO
YES
62
MOUSE BUTTON RELEASED OR NO LONGER OUTSIDE WINDOW ?
NO
YES
63
DISABLE AUTO-SCROLL FUNCTION
64
OTHER MOUSE PROCESSING
56
MOUSE BUTTON DEPRESSED IN WINDOW AND DRAGGED OUTSIDE WINDOW ?
NO
YES
58
ACTIVATE PROPORTIONAL AUTO-SCROLL FUNCTION
60
END THREAD
66
PROPORTIONAL AUTO-SCROLL TIMER EVENT ?
YES
NO
UPDATE AUTOSCROLL BASED ON MOUSE STATE
68
SET TIMER=ΔT
70
END THREAD
60
OTHER MOUSE PROCESSING
64

FIG. 5

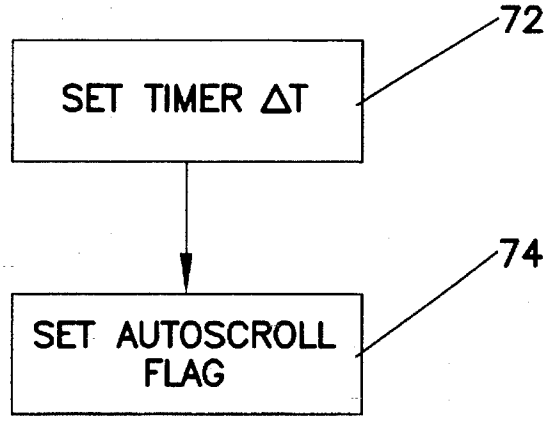


FIG. 6

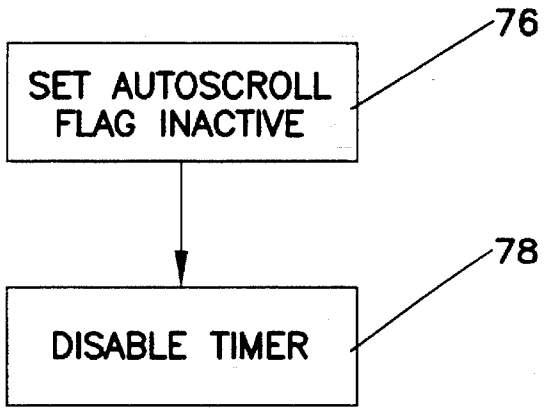


FIG. 7A

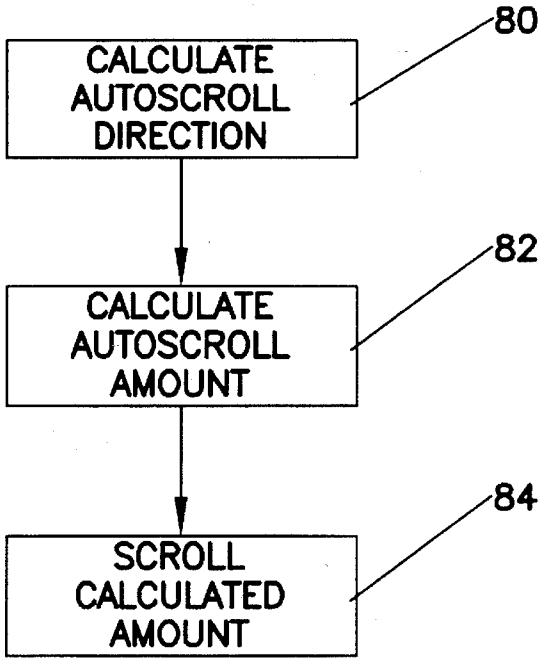


FIG. 7B

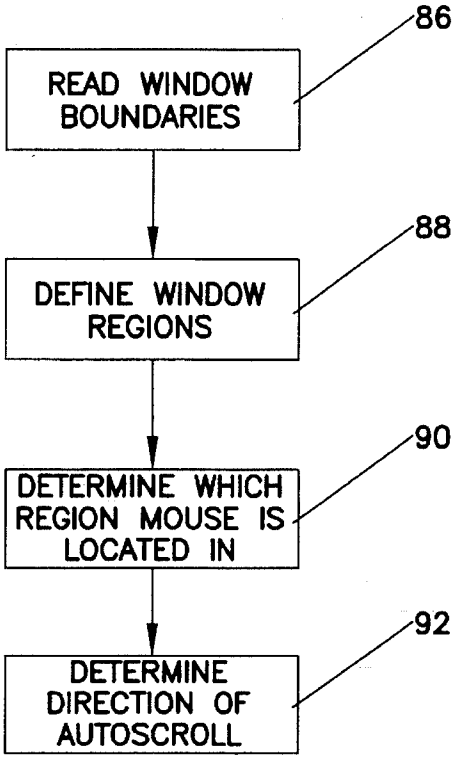
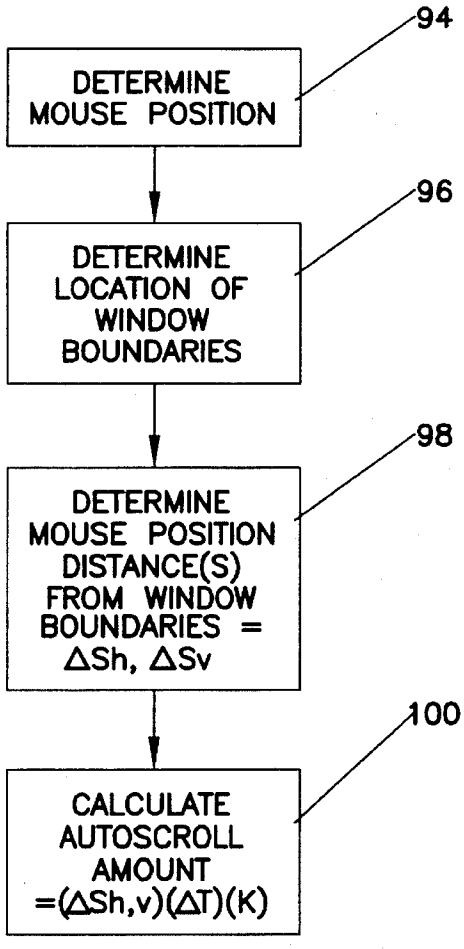

86
READ WINDOW BOUNDARIES
88
DEFINE WINDOW REGIONS
90
DETERMINE WHICH REGION MOUSE IS LOCATED IN
92
DETERMINE DIRECTION OF AUTOSCROLL

FIG. 7C


94
DETERMINE MOUSE POSITION
96
DETERMINE LOCATION OF WINDOW BOUNDARIES
98
DETERMINE MOUSE POSITION DISTANCE(S) FROM WINDOW BOUNDARIES = ΔSh, ΔSv
100
CALCULATE AUTOSCROLL AMOUNT =(ΔSh,v)(ΔT)(K)

METHOD AND APPARATUS FOR PROPORTIONAL AUTO-SCROLLING

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to computer implemented systems for displaying information stored in a file in a computer to a user, and in particular, to a method and apparatus for proportional auto-scrolling through data displayed in a window wherein the scrolling speed and direction is determined by the cursor position on the display.

2. Description of the Related Art

Presenting information to a user with a computer using multiple windows on a display device with a graphical user interface is well known in the art. Also well known in the art is the technique of using a pointing device, such as a mouse or a trackball to select data within the file before a function is applied to the data. Further, the method of using the pointing device to provide graphical input to the window is also well known.

However, these techniques present some unique problems. Typically, the information contained in the file is greater than what can be displayed in the window at one time. Similarly, the user may want to provide graphical input which exceeds the window size. Hence, some method must be employed to allow the user to use the pointing device to select or input information which exceeds the window boundaries.

One possible method to solve this problem is to merely enlarge the window. However, this is useful only when the amount of data is less than the window size.

Another method to solve this problem is to use auto-scroll functions, which are well known in the art. Using auto-scroll methods, the data displayed in the window is automatically scrolled without using the scroll bars when the pointing device is "dragged" outside the window.

These prior art auto-scroll methods, however, are inherently limited and do not fully utilize the capabilities of the graphical user interface. For example, the prior art auto-scrolling methods do not allow the user to control the speed of the auto-scroll. The net result is that the speed of the auto-scroll is often too fast or too slow. The speed of the auto-scroll may be too slow in situations where the user desires to scroll only a small part of the file that is not displayed in the window. Conversely, the speed of the auto-scroll may be too fast in situations where the user desires to select a large amount of text. Analogous problems exist when the user desires to input graphical user inputs larger than the window size. This situation may occur when using paint, draw, or CAD (computer automated design) programs.

Therefore, there exists a need for an intuitive proportional auto-scroll capability for information presented in a window.

BRIEF DESCRIPTION OF THE DRAWINGS

Referring now to the drawings in which like reference numbers represent corresponding parts throughout:

FIG. **1** illustrates one possible embodiment of the present invention;

FIG. **2** is a diagram showing the relationships between the cursor and the window in one possible embodiment of the invention;

FIG. **3** is a diagram showing how the auto-scroll speed and direction may be determined for one possible embodiment of the invention;

FIG. **4** is a flow chart illustrating the logic of the present invention;

FIG. **5** is a flow chart illustrating the proportional auto-scroll activation logic;

FIG. **6** is a flow chart illustrating the proportional auto-scroll disable logic;

FIG. **7A** is a flow chart illustrating the auto-scroll update logic;

FIG. **7B** is a flow chart illustrating the auto-scroll direction logic; and

FIG. **7C** is a flow chart illustrating the auto-scroll speed logic.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

In the following description of the preferred embodiment, reference is made to the accompanying drawings which form a part hereof, and in which is shown by way of illustration a specific embodiment in which the invention may be practiced. It is understood that other embodiments may be utilized and structural changes may be made without departing from the scope of the present invention.

FIG. **1** shows one possible embodiment of the present invention. The present invention comprises a method and apparatus for proportional auto-scrolling through data displayed on a computer **10**. The computer **10** preferably includes a display device **12**, keyboard **14**, mouse pointing device **16** and disk storage **18**. The mouse pointing device **16** is connected to the computer **10** by a connecting cable **20**. Also a printer **22** may be attached to the computer **10** by a cable **24**. Those skilled in the art will recognize that other pointing and selecting devices may be used in place of one mouse pointing device **16**. For example, a trackball or pressure sensor device may be used. Also, pointing and selecting of data on the display device **12** may be accomplished by devices which use physical contact with the display device **12**. Those skilled in the art will also recognize that the display device **12** can be any device capable of presenting information to the user, including cathode ray tube monitors and liquid crystal displays. Of course, the elements described in FIG. **1** may also be integrated into a single package, such as a laptop or notebook computer.

In the preferred embodiment, an application program (not shown) executing under the control of an operating system **26** displays one or more windows **28** on the display device **12** to the user. The proportional auto-scroll function **30** of the present invention is implemented by the computer **10** and is typically embodied either within the application program or the operating system **26** as a function associated with the display of data in the windows **28**.

The proportional auto-scroll function **30** of the present invention is used when only a portion of the available data is displayed in the window **28**. In response to an operator command, the data displayed in the window **28** is automatically scrolled in an operator-selected direction and at an operator-selected speed.

In the preferred embodiment, the proportional auto-scroll function **30** is enabled by an operator based on a cursor's position relative to the window **28**. In particular, the proportional auto-scroll function **30** is enabled when the cursor is either placed or dragged outside the active window **28**.

Of course, those skilled in the art will note that the proportional auto-scroll function **30** may be enabled in several other ways. In one alternative embodiment, the auto-scroll function **30** could be enabled by dragging the cursor position from within the window **28** to outside the window **28**. In another alternative embodiment, the auto-scroll function could be enabled by merely placing the cursor position outside the window **28**.

In a preferred embodiment, the direction and speed indication for the proportional auto-scroll function **30** comprises a cursor position on the display device **12**. Preferably, the direction of the auto-scroll function **30** is determined by the cursor's orientation to the window **28**, and the speed of the auto-scroll function **30** is related to the cursor's distance from the window **28**.

Of course, those skilled in the art will recognize that the speed and direction of the auto-scroll function **30** may be selected in other ways. For example, in one alternative embodiment, the speed of the auto-scroll function **30** may be determined by the period of time that the cursor is located outside the window **28**. In another alternative embodiment, the speed of the auto-scroll function **30** may be selected by depressing buttons on the pointing device **4** or keyboard **14**, singly, in different combinations, or multiple times.

The auto-scroll function **30** of the present invention provides several advantages over prior art auto-scroll methods. First, it allows the user to select the scroll speed. The present invention also allows large files to be scrolled more quickly, while at the same time allowing smaller files to be scrolled more slowly without requiring the user to master the use of any additional buttons or functions. In addition, the scroll speed is selected in an intuitively satisfying way, which is consistent with a graphical user interface (GUI) concept. Further, the auto-scroll function **30** is implemented without requiring any changes in the user interface. With the present invention, the user can easily select both the speed and direction of auto-scroll merely by the position of a cursor relative to the window **28** displayed on the display device **12**.

FIG. **2** is a diagram showing a display screen **34** presented to the user of the computer **10** on the display device **12**. The operating system **26** displays data in a window **28** on the display screen **34**. By manipulating the pointing device **16**, the location of a cursor **38** can be varied to locations throughout the display screen **34**. As described above, the proportional auto-scroll function **30** may be enabled by locating the cursor **38** inside the window **28**, depressing one or more buttons **32** on the pointing device **16**, and moving the cursor **38** to a location outside the window **28**, e.g., the position indicated by **40**.

FIG. **3** is a diagram showing information presented to the user of the computer **10** on the display device **12**. This diagram illustrates one possible implementation for determining the speed and direction of the auto-scroll function **30** from the cursor position. In this example, data **42** is displayed within the window **28**, wherein the window boundary **48** is indicated with a heavy line. Generally, the amount of the data would be larger than the size of the window **28** when the auto-scroll function is used. Hence, data **42** that is contained within the window **28** yet invisible to the user is shown as hidden text **46**. Also shown in FIG. **3** is a cursor position **38** located inside the window **28** and a cursor position **40** located outside the window.

In the preferred embodiment, the speed of the proportional auto-scroll function **30** is calculated by determining the distance of the cursor from horizontal **45** and vertical **47** lines formed by extending the borders of the window to the display screen **34** periphery. When the cursor is dragged to the position **40** outside the window **28**, the vertical and horizontal distance, Δs_v and Δs_h, from the horizontal **45** and vertical **47** lines indicate the desired speed of auto-scroll function **30** in each direction. Of course, those skilled in the art will note that the speed of the auto-scroll function may also be determined in other ways, e.g., the speed may depend on the radial distance of the cursor **44** from the center of the window **28**.

In the preferred embodiment, the direction of the proportional auto-scroll function **30** is determined by dividing the area surrounding the window **28** into eight auto-scroll cursor regions **44**. Each auto-scroll cursor region **44** is adjacent to the window **28** and either directly horizontally opposed to the window **28**, directly vertically opposed to the window **28** or both horizontally and vertically opposed to the window **28**. These regions **44** are used to define the direction of the auto-scroll function **30**. For example, if one of the buttons **32** on the pointing device **16** is depressed with the cursor **38** positioned within the window **28**, and thereafter the pointing device **16** is dragged with the button **32** held down to a cursor position **40** outside the window **28**, then the direction of the proportional auto-scroll function **30** defined by this motion would be determined from the region in which the cursor **40** is located. In the example shown in FIG. **3**, the direction of the auto-scroll function **30** would be down and to the right. Of course, those skilled in the art will note that the auto-scroll cursor regions **44** may also be defined in other ways, e.g., the regions **44** may be defined as extending radially away from the center of the window **28** toward the edges of the display screen **34**.

Those skilled in the art will note that both the speed and direction of the proportional auto-scroll function **30** may also be determined by separating the region outside the window **28** into greater numbers of regions **44** and determining both the speed and direction of the auto-scroll function **30** from the region in which the cursor **40** located outside of the window **28** is positioned. In another alternative embodiment, those skilled in the art will note that both the speed and direction of auto-scroll function **30** may be determined directly from a vector from the boundaries of the window **28** to the cursor position **40** outside the window **28**, or from a vector from the center of one window **28** to the cursor position **40**. This embodiment would have the additional advantage of defining the speed of the auto-scroll function proportional to the window size.

The auto-scroll function **30** may also allow the user to input graphical data exceeding the window boundary **48**. In this embodiment, the auto-scroll function **30** presents graphical user inputs on the display device **12**. Typically, the graphical user inputs are described by positioning the cursor **38** within the window **28**, depressing and holding down the mouse button **32** while the cursor **38** is dragged to other locations within the window **28**. When the graphical user input does not exceed the window boundary **48**, the auto-scroll function **30** is not enabled. When the cursor **38** is dragged to locations **40** outside the window **28**, the graphical user input exceeds the window boundary **48**, and the auto-scroll function **30** is enabled. Those skilled in the art will recognize that in this embodiment, the speed and direction of the auto-scroll function **30** may be controlled as described herein. Also, those skilled in the art will recognize that graphical user inputs may be used to enable the auto-scroll function in other ways. For example, the graphical user input can be defined by the selection of defined objects whose size and location require the auto-scroll function **30** to be enabled to present the object in the window **28**.

FIG. **4** is a flow chart illustrating one embodiment of the logic for implementing the proportional auto-scroll function **30** of the present invention. Block **50** waits for an event to occur, indicating mouse input from the user. Block **52** checks to determine if the mouse event indicates that the auto-scroll function **30** should be enabled. For example, in the preferred embodiment, block **52** will be set to a logical true when a button **32** in the pointing device **16** is depressed when the cursor **38** is located within the window **28**, and thereafter dragged to a position **40** outside the window **28**. In an alternative embodiment, block **52** will be enabled when the cursor **38** is moved to a position **40** outside of the window.

If block **52** indicates that a mouse event has occurred, block **54** determines whether the auto-scroll function **30** is activated. If block **52** indicates that mouse event has not occurred, block **66** checks to determine if a timer event has occurred.

Block **54** determines whether the auto-scroll function **30** is activated. If block **54** indicates that the auto-scroll function **30** is not activated, block **56** checks to determine if a mouse button **32** was depressed within the window **28** and dragged outside of the window **28**. If the result of block **56** is a logical false, the logic reverts to block **64**, returning to other mouse processing. If the result of block **56** is a logical true, block **58** activates the proportional auto-scroll function as described in FIG. **5**, and ordinary processing is resumed in block **60**.

If block **54** indicates that the auto-scroll function **30** is activated, block **62** checks to determine if a mouse button **32** was released or is no longer outside the window **28**. If the result of block **62** is true, block **63** disables the auto-scroll function **30** as described in FIG. **6**, and thereafter, the logic reverts to block **64**, returning to other mouse processing. If the result of block **62** is a logical false, block **66** checks to determine if a timer event has occurred.

If a timer event has occurred as determined by block **66**, auto-scroll is updated based upon the mouse state **68** as described in FIG. 7A. Thereafter the timer is reset to a value of ΔT as shown in block **70**. If a timer event has not occurred as determined by block **68**, other mouse processing **64** is selected.

Other embodiments of the auto-scroll speed and direction logic are possible. For example, the speed of the auto-scroll function **30** may be set by varying the timer value, ΔT, instead of Δs_v and Δs_n. Also, the auto-scroll function **30** may be implemented using simple polling techniques instead of event loops.

FIG. **5** is a flow chart illustrating the proportional auto-scroll activation logic. Block **72** sets the auto-scroll timer to a value of ΔT, and block **74** sets the auto-scroll flag.

FIG. **6** is a flow chart illustrating the proportional auto-scroll disable logic. Block **76** sets an auto-scroll flag to inactive status. Block **78** disables the auto-scroll timer.

FIG. 7A is a flow chart illustrating the auto-scroll update logic. Block **80** calculates the auto-scroll function **30** direction. Block **82** calculates the auto-scroll amount as described in FIG. 7C. Block **84** scrolls the calculated amount.

FIG. 7B is a flow chart illustrating the auto-scroll direction logic. Block **86** reads the window boundaries. Block **88** defines window regions **88**. Block **90** determines which region the cursor is located in, and block **92** determines the direction of the auto-scroll function **30**. The window region defined in block **88** ordinarily correspond to the auto-scroll cursor regions **44**. Further, the direction of auto-scroll **92** is determined from which region the mouse is located in as calculated in block **90**. For example, if the cursor **38** is located outside the window **28** as shown in FIG. **3**, then the direction of the auto-scroll function **30** is determined to be down and to the right.

FIG. 7C is a flow chart illustrating the logic employed in calculating the auto-scroll amount or speed. Block **80** determines the position of the cursor **38**. The position of the cursor **38** is determined in block **94**. Block **96**, determines the location of the window **28** boundaries. This step is ordinarily analogous to that performed in block **86**. Block **98** determines the distance from the mouse position to each window boundary. Block **100** uses these distances, denoted Δs_h for the horizontal distance and Δs_v for the vertical distance, to calculate the auto-scroll amount. In one embodiment, auto-scroll amount in the horizontal direction is calculated as a product of the distance from the window boundary in the horizontal direction, Δs_h, the value of the timer ΔT and a constant K selected either by the user or by the program to control the auto-scroll scaled speed. For example, if either the user or the application program containing the auto-scroll function **30** desires greater sensitivity, the value of K would be proportionally increased so that the auto-scroll amount would be larger for given values of Δs_h or Δs_v and ΔT. The auto-scroll speed in the vertical direction is calculated the same way, but using the distance from the window boundary in the vertical direction, Δs_v.

In an alternative embodiment, the speed of the auto-scroll function **30** is determined by the vector distance from the center of the window **28** to the cursor position outside of the window **40**. Further, in another alternative embodiment, block **88** defines auto-scroll cursor regions **44** radially from the window **28**, and these regions are used to define the direction of auto-scroll in block **92**. Finally, in yet another alternative embodiment, block **88** defines a number of auto-scroll cursor regions **44** sufficient to define both the speed and direction of the auto-scroll function **30**, and the speed and direction of auto-scroll are determined from the location of the cursor **38**. For example, if twenty-four auto-scroll cursor regions **44** are defined, both the speed and direction of the proportional auto-scroll function **30** are be determined from the location of the cursor **38**.

This concludes the description of the preferred embodiment of the invention. In summary, the present invention discloses a system by which information contained in the files stored in the computer are automatically and proportionately scrolled in a direction and speed selected by the user. This is accomplished by displaying at least a portion of the file's contents in a window on a monitor attached to the computer, accepting operator input to enable proportional auto-scroll function, and performing the proportional auto-scroll function according to the operator input. Systems and methods have been described by which the operator input comprises a direction and speed indication, and the direction and speed of the auto-scroll is accordingly selected. Further, the present invention discloses a system and method wherein a cursor positioned on the monitor determines the direction and speed of the auto-scroll, and in one embodiment, the cursor's distance from the window is used to determine the speed of auto-scroll.

The foregoing description of the preferred embodiment of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Many modifications and variations are possible in light of the above teaching. It is intended that the scope of the invention be limited not by this detailed description, but rather by the claims appended hereto.

What is claimed is:

1. A method of proportionally auto-scrolling through information on a display attached to a computer, comprising the steps of:

(a) presenting at least a portion of the information in a window on the display, the window defined by borders dividing the display into a window region and a surrounding display region;

(b) logically subdividing the surrounding display region into a plurality of auto-scroll cursor regions defined by horizontal and vertical lines formed by extending the borders from the window to an outer periphery of the display;

(c) accepting operator input into the computer to enable a proportional auto-scrolling function, the operator input comprising a selected cursor position in one of the auto-scroll cursor regions;

(d) computing a proportional auto-scroll direction and said in the computer using the operator input, the auto-scroll direction being determined from the auto-scroll cursor region in which the selected cursor position is located, and the auto-scroll speed being determined by a distance from the selected cursor position to the nearest one of the vertical lines and a distance from the selected cursor position to a nearest one of the horizontal lines; and

(e) performing the proportional auto-scrolling function according to the computed auto-scroll direction and speed, wherein the proportional auto-scrolling function comprises successively presenting portions of the information on the display according to the computed auto-scroll direction and speed.

2. The method of claim 1, wherein the auto-scroll speed is computed in rectangular coordinates.

3. The method of claim 1, wherein the auto-scroll direction is computed in rectangular coordinates.

4. The method of claim 1, wherein the operator input comprises the steps of locating the cursor inside the window, depressing at least one button on a pointing device controlling the cursor, and moving the cursor from the window region to an auto-scroll cursor region.

5. A program storage device readable by a computer and tangibly embodying a program of instructions executable by the computer to perform method steps for proportionally auto-scrolling information on a display attached to a computer, the method steps comprising the steps of:

(a) presenting at least a portion of the information in a window on the display, the window defined by borders dividing the display into a window region and a surrounding display region;

(b) logically subdividing the surrounding display region into a plurality of auto-scroll cursor regions defined by horizontal and vertical lines formed by extending the borders from the window to an outer periphery of the display;

(c) accepting operator input into the computer to enable a proportional auto-scrolling function, the operator input comprising a selected cursor position in one of the auto-scroll cursor regions;

(d) computing a proportional auto-scroll direction and speed in the computer using the operator input, the auto-scroll direction being determined from the auto-scroll cursor region in which the selected cursor position is located, and the auto-scroll speed being determined by a distance from the selected cursor position to the nearest one of the vertical lines and a distance from the selected cursor position to a nearest one of the horizontal lines; and

(e) performing the proportional auto-scrolling function according to the computed auto-scroll direction and speed, wherein the proportional auto-scrolling function comprises successively presenting portions of the information on the display according to the computed auto-scroll direction and speed.

6. The method of claim 5, wherein the auto-scroll speed is computed in rectangular coordinates.

7. The method of claim 5, wherein the auto-scroll direction is computed in rectangular coordinates.

8. The method of claim 1, wherein the operator input comprises the steps of locating the cursor inside the window, depressing at least one button on a pointing device controlling the cursor, and moving the cursor from the window region to an auto-scroll cursor region.

9. A device for proportionally auto-scrolling through information on a display attached to a computer, comprising:

(a) means, performed by the computer, for presenting at least a portion of the information in a window on the display, the window defined by borders dividing the display into a window region and a surrounding display region;

(b) means, performed by the computer, for logically subdividing the surrounding display region into a plurality of auto-scroll cursor regions defined by horizontal and vertical lines formed by extending the borders from the window to an outer periphery of the display;

(c) means, performed by the computer, for accepting operator input into the computer to enable a proportional auto-scrolling function, the operator input comprising a selected cursor position in one of the auto-scroll cursor regions;

(d) means, performed by the computer, for computing a proportional auto-scroll direction and speed from the operator input, the auto-scroll direction being determined from the auto-scroll cursor region in which the selected cursor position is located, and the auto-scroll speed being determined by a distance from the selected cursor position to the nearest one of the vertical lines and a distance from the selected cursor position to a nearest one of the horizontal lines; and

(e) means, performed by the computer, for performing the proportional auto-scrolling function according to the computed auto-scroll direction and speed, wherein the proportional auto-scrolling function comprises successively presenting portions of the information on the display according to the computed auto-scroll direction and speed.

10. The device of claim 9, wherein the auto-scroll speed is computed in rectangular coordinates.

11. The device of claim 9, wherein the auto-scroll direction is computed in rectangular coordinates.

12. The device of claim 9, wherein the operator input comprises locating the cursor inside the window, depressing at least one button on a pointing device controlling the cursor, and moving the cursor position from the window region to an auto-scroll cursor region.

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UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 5,528,260

DATED : June 18, 1996

INVENTOR(S) : William J. Kent

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 7, line 19, before "in", "said" should read --speed--.

Signed and Sealed this

Nineteenth Day of November, 1996

Attest:

BRUCE LEHMAN

Attesting Officer

Commissioner of Patents and Trademarks